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HARRIS,

C.E.

Deer Mouse and Yellow-Pine Chipmunk Density and Food Habits in Three Central Idaho Shrub Communities

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FS contact: K. Geier-Hayes
CoOp contact: C.R. Groves

Deer Mouse and Yellow-Pine Chipmunk Density and Food Habits in Three Central Idaho Shrub Communities

by

Charles E. Harris and Jonathan W. Beals
Nongame and Endangered Wildlife Program
Bureau of Wildlife

and

Kathleen Geier-Hayes
Forestry Sciences Laboratory
Intermountain Research Station

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Idaho Department of Fish and Game
600 S. Walnut, P.O. Box 25
Boise, ID 83707
Jerry M. Conley, Director

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ABSTRACT

Small mammals were live-trapped in 3 shrub community types within 3 Douglas-fir (*Pseudotsuga menziesii*) habitat types (Douglas-fir/elksedge [*Pseudotsuga menziesii/Carex geyeri*], Douglas-fir/white spirea [*Pseudotsuga menziesii/Spiraea betulifolia]* and Douglas-fir/mountain maple [*Pseudotsuga menziesii/Acer glabrum]*) June through September 1993 on the Boise National Forest to estimate density, monitor seasonal habitat use, and determine food habits. We trapped 3,080 individual small mammals of 10 species in 28,968 trap-nights. Deer mice and yellow-pine chipmunks comprised 44% and 47%, respectively, of the total individuals captured. Estimated population sizes of deer mice ranged from 100 to 195 and densities ranged from 16.0 to 34.5/ha. Estimated densities fluctuated within and between the shrub community types, but there were no significant differences. Estimated population sizes of yellow-pine chipmunks ranged from 51 to 262 and densities ranged from 6.9 to 36.5/ha. Densities again fluctuated within and between shrub community types, but there were no significant differences. Berries and seeds comprised the most significant proportions of food items in the stomachs of deer mice, with invertebrates and forbs/ferns being significant food items during certain sampling periods. Conifer seeds were detected in the diet only during the September samples. Berries and seeds also comprised the most significant component of yellow-pine chipmunk diets, with lichens/mushrooms being important components in some sample periods.

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INTRODUCTION

Small mammal populations are an important component of montane forest communities in the western United States. They contribute to forest biodiversity, trophic dynamics, and community interactions. Plant communities are influenced by small mammal populations through consumption, dispersal, and caching of seeds (Hayward and Phillipson 1979, McAuliffe 1990, Vander Wall 1993). Conversely, small mammal communities are influenced by plant community variables such as vegetative composition, structure, cover and height, relative humidity, litter depth and other microhabitat features of forest habitats, that in turn are affected by forest management practices (Goodwin and Hungerford 1979, Campbell and Clark 1980, Ramirez and Hornocker 1981, Gunther et al. 1983, Scrivner and Smith 1984, McCracken et al. 1985, Alder 1988, Raphael 1988, Rosenberg and Anthony 1993).

Of particular interest to the Boise National Forest are the potential for small mammal seed caches to be an important source of natural regeneration of ponderosa pine (*Pinus ponderosa*) (Saigo 1969, West 1978, Vander Wall 1992). In this study we: (1) determined small mammal composition and density in 3 shrub community types occurring in 3 central Idaho habitat types; (2) determined small mammal use of the community types throughout the growing season; and (3) determined dietary habits of small mammals in the shrub community types. A separate study measured vegetation composition and surveyed the 3 shrub communities for natural regeneration emphasizing regeneration from seed caches.

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STUDY AREA

We conducted the study within the Mountain Home Ranger District of the Boise National Forest in the Feather River watershed near the town of Featherville, Elmore County, Idaho (Fig. 1). We selected 1 study plot within each of 3 shrub community types occurring in three habitat types: Douglas-fir/elksedge (*Pseudotsuga menziesii/Carex geyeri*), Douglas-fir/white spirea (*Pseudotsuga menziesii/Spiraea betulifolia*), and Douglas-fir/mountain maple (*Pseudotsuga menziesii/Acer glabrum*)

(Steele et al. 1981). Elevations ranged from 1,585 to 1,707 m. Slopes were steep and dissected. All sites had been logged between 1978 and 1984, broadcast burned, and planted. The area has a Mediterranean climate with hot, dry summers and cool, moist winters.

METHODS

Population Composition and Estimation

We established 1 live-trapping grid in each of the 3 shrub community types (Grid A, T4N R10E SE1/4 SW1/4 Sec. 20, Red Warrior Creek; Grid B, T4N R10E NW1/4 SW1/4 Sec. 26, Pony Ridge; Grid C, T4N R10E SW1/4 SW1/4 Sec. 23, Democrat Gulch). Grids varied from a 15 x 15 square array to more rectangular arrays, depending upon the size and shape of the community type. All grids contained 225 trap stations with 15-m spacing. One Sherman live-trap (7.6 x 7.6 x 25.4 cm or 7.6 x 9.5 x 30.5 cm) baited with a rolled oats and peanut butter mixture was placed at each station. Polyester batting and a millet/sunflower seed mixture was provided in each trap for bedding and food. Each grid was trapped for 4 sessions 21 June through 2 October 1993 for 6 consecutive days per session and checked 2 times per day. Only 1 grid was trapped per week, and each grid was trapped at 4-week intervals. At first capture for each session animals were weighed, sexed, aged as juveniles, subadults, or adults, checked for reproductive condition, and eartagged with #1 monel tags (Nat. Band and Tag Co., Newport, Ky.).

Any single trap type can be biased in their sampling of small mammal communities because of differential capture vulnerability to a given trap type (Williams and Braun 1983, Mengak and Gunn 1987, Szaro et al. 1988, McComb et al. 1991, Slade et al. 1993). We therefore established a pitfall trap array consisting of 2 triads spaced 25 m apart in association with each trapping grid (Bury and Corn 1987) to capture small mammals, particularly shrews, that may not be captured with livetraps. Each triad contained 3 5-m-long drift fences, radiating outward beginning 3 m from the center at 120^0 spacing with a pitfall trap at each end of the drift fence. Pitfall traps were constructed of 2 No. 10 tins (15.7 cm diameter x 17.8 cm deep) connected with duct tape. No water was used in the bottom of the pitfalls. Pitfall arrays were run concurrently with the grids during trapping sessions 3 and 4. Dr. Don Johnson, University of Idaho, identified captured shrews to species.

We estimated small mammal population size (N) and density (D) for each trapping session using capture-recapture analysis based upon the closed population models of program CAPTURE (Otis et al. 1978, White et al. 1982). We used only morning captures

to estimate deer mouse density as very few were captured in the afternoon trapping. Only afternoon captures were used to estimate yellow-pine chipmunk density. Because of the differences in the number of morning and afternoon captures for chipmunks, time was a significant variable in the model selection criteria of CAPTURE along with behavior and heterogeneity. This lead to either M_{tbh} being selected as the most appropriate model, for which there is no estimator, or very low model selection criteria values for the other models.

Animals that died before the last day of trapping for each session were omitted from the capture-recapture analysis, but were added to the estimated population size if mortalities were less than 5% of total captures. If trap mortalities exceeded 5% of total captures we used the general removal model M_{bh} (White et al. 1982:171). We estimated the area effectively trapped (A) by each grid by adding one-half of the mean maximum distance moved (MMDM) between trap locations to the grid's perimeter (Wilson and Anderson 1985). We estimated density as D = N/A. Differences in population size and density were analyzed using a two-tailed z-test (White et al. 1982:139). Differences in MMDM were analyzed with a Mann-Whitney *U*-test (Zar 1974:109). An $\alpha = 0.05$ was used in all tests.

Food Habits

We collected and froze stomachs from 5-10 deer mice (*Peromyscus maniculatus*) and yellow-pine chipmunks (*Tamias ameonus*), respectively, from each shrub community type during each of the 4 trapping sessions. We did not use trap mortalities from the grids for food habits analysis because of the potential bias associated with consumption of seeds placed in the traps for a food source. We set Museum Special snaptraps baited with peanut butter and rolled oats in the same shrub community type well away from the grids to avoid trapping marked animals.

Dr. Bruce Davitt, Wildlife Habitat Laboratory, Washington State University, conducted the food habits analysis. He determined botanical composition of stomach contents microhistologically by modifying existing frequency - density conversion sampling procedures of Sparks and Malachek (1968), Flinders and Hansen (1972), Holechek and Vavra (1981), and Holechek and Gross (1982). Relative cover (Korfhage 1974, Davitt 1979) of plant cuticle and epidermal fragments were quantified for 25 randomly located microscope views on each of 8 slides (total 200 views) from a composite food sample for each species, grid, and trapping period. A 10 x 10 square grid mounted in the eyepiece of the microscope was used to measure area covered by each positively identified fragment observed at 100x magnification. Larger magnification (200x to 450x) was used to aid in identification of discernable fragments (Holechek and

Valdez 1985). Measurements of area covered were recorded by plant species, genus, or forage class category as desired. Percent diet composition is calculated by dividing cover of each plant by total cover observed for all species, then multiplying by 100.

Shrub Community Composition and Ponderosa Pine Seed Caching

We determined shrub community composition and species frequencies using canopy line intersects. Each community type was subdivided into sixteen 60 m by 60 m blocks containing 4 potential sampling lines 15 meters apart; we randomly chose 2 in each block for sampling. The blocking was used to identify potential community composition mosaics based on microsites or site disturbance differences. The initial starting point for the block transects was determined from an azimuth shot at a randomly selected downslope landscape feature. This same azimuth was then used throughout the community regardless of the terrain. After we sampled each block, we mapped and numbered the block on a site map describing the area.

The sampling lines were established perpendicular to and 5 meters in from the transect. We recorded, in decimeters, the point along the sampling line where we first and last encountered each individual shrub. Canopy irregularities for individual shrubs that broke the intercept were treated as separate encounters.

Species canopy coverage for each sampling line was calculated by adding the total sampling line distance intercepted by each species, dividing by the sampling line length (150 dm), and multiplying by 100. The percents were then averaged for the blocks and finally for the entire Grid. Frequency was determined by adding up the number of sampling lines in which the species occurred and dividing by 32 (16 blocks x 2 sampling lines per block). Each block was classified according to the seral community classification for central Idaho to determine seral status (Steele and Geier-Hayes 1987, 1989, 1994).

We inspected the transect line for ponderosa pine germinants to identify seed caches. We verified whether germinants originated from seed caches by excavating the germinants and checking their origin. Germinants arising from a seed cluster were recorded as caches. Potential single seed caches could not be differentiated from natural seed fall.

RESULTS

Population Composition and Estimation

We trapped 3,080 individual small mammals of 10 species in

28,968 trap-nights during the 4 trapping sessions (Table 1). Deer mice and yellow-pine chipmunks comprised 44% and 47%, respectively, of the total individuals captured. We captured only 17 individuals of 4 species (10 shrews, 1 deer mouse, 5 montane voles, and 1 red-backed vole) during 1,260 trap-nights of effort with the pitfall traps.

Of 54 shrew specimens collected, 49 were dusky shrews (*Sorex monticolus*), 2 were masked shrews (*S. cinereus*), and 1 has tentatively been identified as a dwarf shrew (*S. nanus*). If the dwarf shrew specimen identification is confirmed, it will be only the second record of this species in Idaho (Dr. Don Johnson, pers. commun.).

Estimated population sizes of deer mice ranged from 100 to 195 (Table 2) and densities ranged from 16.0 to 34.5/ha (Table 3). Estimated densities fluctuated within and between shrub community types, but there were no significant differences. Estimated population sizes of yellow-pine chipmunks ranged from 51 to 262 (Table 4) and densities ranged from 6.9 to 36.5/ha (Table 5). Densities again fluctuated within and between shrub community types, but there were no significant differences.

MMDM was greater for deer mice on grid C than grids A ($U_{4,4}$ = 16, P = 0.05) and B ($U_{4,4}$ = 16, P = 0.05) (Table 6). MMDM was also greater for yellow-pine chipmunks on grid C than grids A ($U_{4,4}$ = 16, P = 0.05) and B ($U_{4,4}$ = 16, P = 0.05) (Table 6).

Food Habits

Berries and seeds comprised the most significant proportions of food items identified in the stomachs of deer mice during our sampling periods of June-September (Table 7). During some sampling periods invertebrates and forbs/ferns also contributed a major portion of the diet. Only during the last (September) trapping session on grid A did conifer seeds comprise a large proportion (20.9%) of the diet. Berries and seeds were likewise the most significant component of the diet of yellow-pine chipmunks (Table 8). During some sampling periods nut meat and lichens/mushrooms were important components of the diet, with invertebrates seldom being taken in the proportions that deer mice did.

Shrub Community Composition and Ponderosa Pine Seed Caches

We sampled all shrub species except white spirea. Upright simple branching rhizomatous species like white spirea are difficult to measure using canopy line intercepts. Even though other rhizomatous or root sprouting species like Oregon-grape and cherry were present, they produce more measurable branches and clumps. Though we did not record white spirea, we noted its

occurrence and found that its frequency was similar at all 3 sites.

We identified Grid A as an early seral vegetative community type in all but one block (Steele and Geier-Hayes 1987). Ceanothus (*Ceanothus veluntinus*), an early seral indicator species, dominated most of the site (Table 9). The CEVE-CEVE (*Ceanothus velutinus-Ceanothus velutinus)* community type occuppied the most area with CEVE-AMAL (*Ceanothus velutinus-Amelanchier alnifolia*), CEVE-PRVI (*Ceanothus velutinus-Prunus virginiana*), and CEVE-SASC (*Ceanothus velutinus-Salix scouleriana)* inclusions (Table 10). Overall, Grid A was the most homogeneous of the 3 Grids.

Grids B and C had similar shrub species compositions (Table 9). The most common community types on Grid B were mid-seral to late seral PRVI-PRVI (*Prunus virginiana-Prunus virginiana)* and AMAL-AMAL (*Amelanchier alnifolia-Amelanchier alnifolia)* with small CEVE-AMAL inclusions (Table 10) (Steele and Geier-Hayes 1989). The ceanothus occurred in the few burned slash piles scattered through the area. For the most part however, the community types throughout Grid B were relatively homogeneous.

Grid C contained the most diverse community types (Table 10) (Steele and Geier-Hayes 1994) even though Grid B had similar species composition (Table 9). Though early seral CEVE community types dominated a large area, small, mixed patches of mid-seral and late seral communities occurred around the ceanothus. The community type mix on Grid C was the least homogeneous of the Grids.

We encountered 1 ponderosa pine cache on Grid B and observed 3 others as we walked through the areas. No caches were found on other Grids. The conifer seed crop prior to the sampling was poor and little seed may have been available. In addition to the ponderosa pine caches on Grid B, we also noted several mountain snowberry caches.

DISCUSSION

The composition of small mammal species on our trapping grids was very similar to that found by Medin (1986) and Medin and Booth (1989)in Douglas-fir/ninebark (*Physocarpus malvaceous*) habitat type, ponderosa pine phase, and Douglas-fir/white spirea habitat type, ponderosa pine phase approximately 90 km northwest of Featherville.

Our deer mouse density estimates of 16.0 to 34.5/ha are higher than those reported by Medin (1986) and Medin and Booth (1989) and in the range of densities reported by Goodwin and Hungerford (1979). Medin (1986) and Medin and Booth (1989)

reported densities of deer mice from 0.5 to 12.5/ha on unlogged areas and 0.9 to 2.5/ha on logged areas. Other studies in the West have produced similar results with higher deer mouse populations in uncut vs. recently cut forests (Petticrew and Sadlier 1974, Sullivan 1979), however, more studies seem to find higher relative abundance or densities of deer mice on logged and early successional habitats than on unlogged areas or later successional stages (Tevis 1956*a*, Gashwiler 1970, Hooven and Black 1976, Ramirez and Hornocker 1981, Van Horn 1981, Halvorson 1982). Goodwin and Hungerford (1979) reported densities of deer mice in a northern Arizona ponderosa pine forest of 5.0 to 47.5/ha with densities positively correlated to the amount of slash and downed logs. With deer mice being one of the most common species in many habitat types, their abundance is probably closely related to the amount of cover present and available food items. Another possibility is that recently logged areas act as dispersal sinks for deer mice (Sullivan 1979) and we should be cautious about implying any relationship of habitat quality in these areas with deer mouse population abundance (Van Horne 1983).

Medin (1986) and Medin and Booth (1989) reported densities of yellow-pine chipmunk populations from 2.0 to 6.8/ha on unlogged areas and 2.5 to 10.3/ha on logged areas. With the exception of the first trapping session on Grid A, all of our density estimates for yellow-pine chipmunks were higher (13.3-36.5/ha). There is little other work on the population dynamics and habitat relationships of this species. More work has been done on the Townsend's chipmunk (*Tamias townsendii*) in western Oregon and Washington (Tevis 1956*a*, Gashwiler 1970, Hooven and Black 1976) and on the red-tailed chipmunk (*Tamias ruficaudus*) in north Idaho and western Montana (Ramirez and Hornocker 1981, Halvorson 1982, Scrivner and Smith 1984).

Most rodents are very adaptable in their food habits and are often considered opportunistic in their choice of food items in a given habitat at a given time. Deer mice in the western U.S. have been reported to feed primarily on seeds, fruits, and invertebrates (Jameson 1952, Tevis 1956*a,b*, Williams 1959, Johnson 1961, Goodwin and Hungerford 1979, Gunther et al. 1983). Chipmunks are also known to have broad diets that include seeds, invertebrates, vegetation, fungi, and lichen (Tevis 1952, 1953, 1956*b*; Goodwin and Hungerford 1979; Gunther et al. 1983). With the exception of 1 trapping session on 1 grid, conifer seeds did not comprise a significant proportion of the diet of either species. We did not measure availability of the various food types to determine any type of preference or selectivity. Conifer seeds may simply have been scarce in these shrub dominated communities until the September trapping session.

That we found no significant differences in deer mouse or yellow-pine chipmunk populations in the 3 shrub community types

and that they occurred in high densities is indicative that these community types are presently providing excellent conditions for the species' microhabitat needs and food requirements. Both species are prey of numerous mammalian and avian predators; consumers of seeds, herbaceous plant material, and fungi; potential dispersers of mycorrhizal fungi (Maser et al. 1978); and are hence a significant component of the trophic dynamics and community interactions of this forest.

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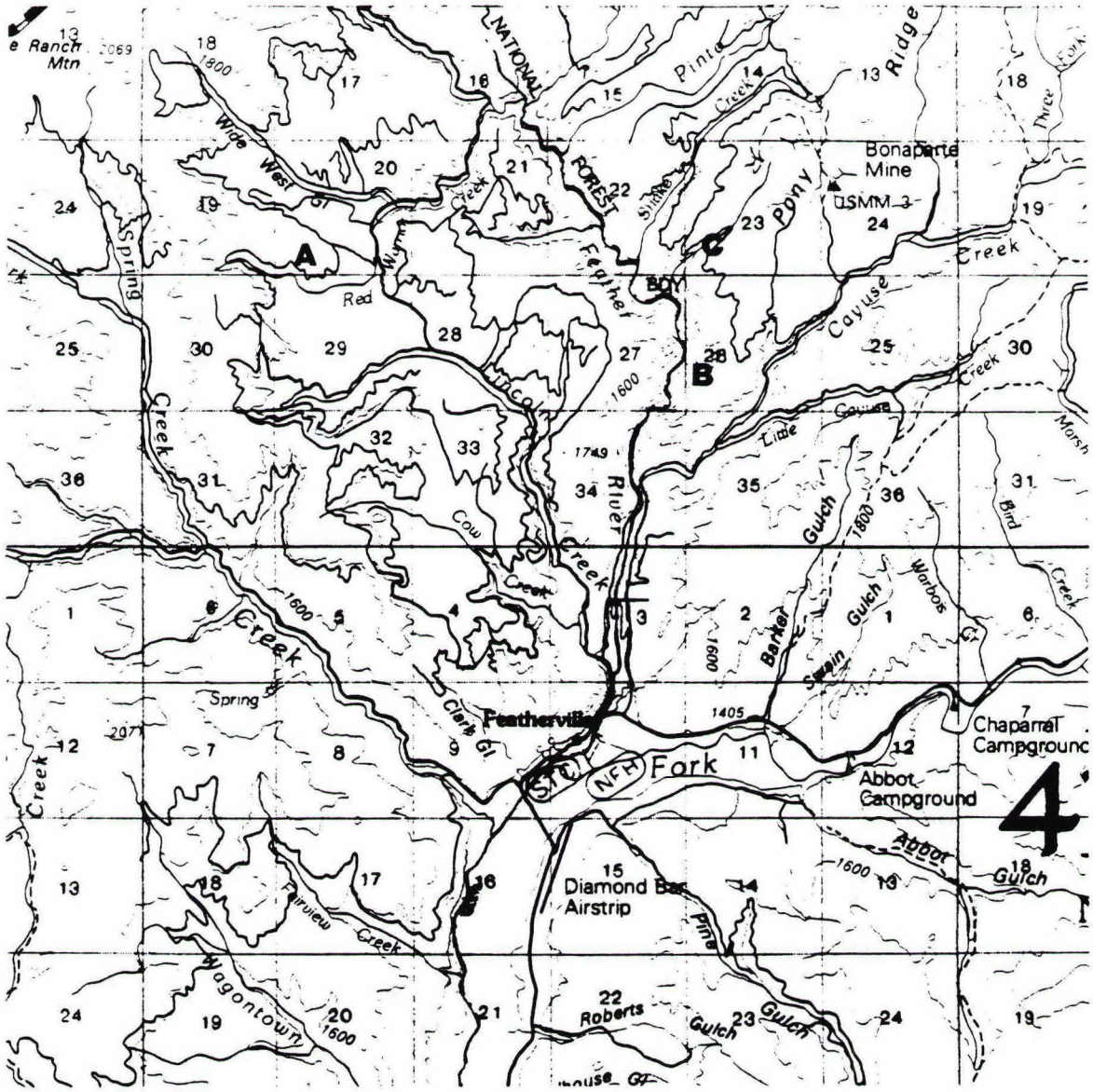

Fig. 1. Location of 3 areas where small mammal trapping was conducted on the Boise National Forest, Idaho, 1993.

Table 1. Species composition and number of individuals captured in 3 shrub community types, Boise National Forest, Idaho, 1993.

	GRID A						GRID B						GRID C					
	TRAP SESSION						TRAP SESSION						TRAP SESSION					
SPP[a]	1	2	3	4	X	SE	1	2	3	4	X	SE	1	2	3	4	X	SE
SOSP	12	19	21	17	17.25	1.93		1		8	2.25	1.93	1	7	6	6	5.00	1.35
TAAM	45	108	122	124	99.75	18.59	193	160	136	130	154.75	14.30	131	94	113	101	109.75	8.10
SPCO	4	37	4		11.25	8.64	6	11			4.25	2.66	7	6			3.25	1.89
SPLA							12	8	1		5.25	2.87	15	6	1		5.55	3.43
TAHU													1					
GLSA				1														
PEMA	105	110	148	128	122.75	9.76	92	109	94	90	96.25	4.33	112	127	123	100	115.50	6.06
NECI													1					
CLGA				1			1						4					
MIMO	3		6	8	4.25	1.75	7	8	12	7	8.50	1.19	1	5	3	1	2.50	0.96
TOTAL	169	274	301	279			311	297	243	235			272	245	246	208		

[a] SOSP, Shrews (*Sorex* sp.)
TAAM, Yellow-pine Chipmunk (*Tamias amoenus*)
SPCO, Columbian Ground Squirrel (*Spermophilus columbianus*)
SPLA, Golden-mantled Ground Squirrel (*Spermophilus lateralis*)
TAHU, Red Squirrel (*Tamiasciurus hudsonicus*)
GLSA, Northern Flying Squirrel (*Glaucomys sabrinus*)
PEMA, Deer Mouse (*Peromyscus maniculatus*)
NECI, Bushy-tailed Woodrat (*Neotoma cinerea*)
CLGA, Southern Red-backed Vole (*Clethrionmys gapperi*)
MIMO, Montane Vole (*Microtus montanus*)

Table 2. Deer mouse population estimates in 3 shrub community types, Boise National Forest, Idaho, 1993.

Grid	Session	Model[a]	Population Estimate	SE	95% CI
A	1	m_{bh}	119	7.3	108 - 140
	2	m_{h}	130	9.2	119 - 156
	3	m_{h}	195	14.5	172 - 229
	4	m_{bh}	145	12.5	132 - 188
	Mean		147	33.6	81 - 213
B	1	m_{h}	115	8.9	103 - 139
	2	m_{bh}	129	15.0	114 - 181
	3	m_{h}	110	8.1	101 - 134
	4	m_{bh}	118	24.9	96 - 215
	Mean		118	8.0	102 - 134
C	1	m_{th}	127	5.6	119 - 141
	2	m_{bh}	134	6.6	128 - 157
	3	m_{bh}	131	5.4	124 - 148
	4	m_{bh}	100	1.2	100 - 108
	Mean		123	15.6	92 - 154

[a] See Otis et al. (1978) or White et al. (1982) for model descriptions.

Table 3. Deer mouse density estimates (mice/ha) from 3 shrub community types, Boise National Forest, Idaho, 1993.

Grid	Session	Density Estimate	SE	95% CI
A	1	19.6	8.5	3 - 36
	2	21.7	8.2	6 - 38
	3	34.5	11.0	13 - 56
	4	23.8	7.7	9 - 39
	Mean	24.9	6.6	12 - 38
B	1	20.0	8.2	4 - 36
	2	22.2	8.3	6 - 38
	3	19.3	7.3	5 - 34
	4	21.1	9.3	3 - 39
	Mean	20.7	1.3	18 - 23
C	1	20.2	7.3	6 - 35
	2	20.2	6.3	8 - 33
	3	20.6	6.6	8 - 34
	4	16.0	5.5	5 - 27
	Mean	19.3	2.2	15 - 24

Table 4. Yellow-pine chipmunk population estimates in 3 shrub community types, Boise National Forest, Idaho, 1993.

Grid	Session	Model[a]	Population Estimate	SE	95% CI
A	1	m_h	51	5.1	46 - 67
	2	m_h	119	12.6	105 - 158
	3	m_h	204	24.8	168 - 267
	4	m_h	135	9.1	124 - 160
	Mean		127	62.8	4 - 250
B	1	m_{bh}	262	44.4	208 - 396
	2	m_{th}	164	12.1	147 - 195
	3	m_h	177	17.8	151 - 222
	4	m_h	150	9.0	138 - 174
	Mean		191	54.8	84 - 298
C	1	m_{bh}	117	6.3	111 - 138
	2	m_{bh}	124	34.6	90 - 246
	3	m_{bh}	122	13.7	107 - 165
	4	m_h	133	8.4	102 - 136
	Mean		124	6.7	111 - 137

[a] See Otis et al. (1978) or White et al. (1982) for model descriptions.

Table 5. Yellow-pine chipmunk density estimates (chipmunks/ha) from 3 shrub community types, Boise National Forest, Idaho, 1993.

Grid	Session	Density Estimate	SE	95% CI
A	1	6.9	4.2	0 - 15
	2	16.5	6.4	4 - 29
	3	28.8	12.2	5 - 53
	4	17.7	6.5	5 - 31
	Mean	17.5	9.0	0 - 35
B	1	36.5	13.0	11 - 62
	2	21.2	8.7	4 - 38
	3	22.7	8.2	7 - 39
	4	19.5	6.6	7 - 33
	Mean	25.0	7.8	10 - 40
C	1	13.7	4.7	7 - 20
	2	15.0	7.3	1 - 29
	3	13.3	5.7	2 - 25
	4	16.2	6.5	4 - 29
	Mean	14.6	1.3	12 - 17

Table 6. Mean maximum distance moved (MMDM) for deer mice and yellow-pine chipmunks in 3 shrub community types, Boise National Forest, Idaho, 1993.

Grid	Session	Deer Mouse MMDM	Deer Mouse SE	Yellow Pine Chipmunk MMDM	Yellow Pine Chipmunk SE
A	1	36.6	7.4	62.9	17.0
	2	35.1	6.2	58.5	9.9
	3	27.8	4.3	56.3	10.7
	4	36.2	5.3	66.0	10.8
	Mean	33.9	4.1	60.9	4.4
B	1	36.2	7.0	62.9	9.1
	2	37.5	6.3	72.6	14.6
	3	35.1	6.2	73.7	11.6
	4	32.9	6.1	72.2	11.0
	Mean	35.4	1.9	70.3	5.0
C	1	41.4	7.0	80.0	12.6
	2	48.0	7.4	78.0	15.5
	3	42.9	6.4	93.5	17.0
	4	40.8	6.6	77.1	13.7
	Mean	43.3	3.3	82.9	7.5

Table 7. Percent relative frequency of food items in deer mouse stomach contents from 3 shrub community types, Boise National Forest, Idaho, 1993.

Grid	A				B				C			
Session Food Item	1	2	3	4	1	2	3	4	1	2	3	4
Conifer needle					0.2		0.6					
Conifer seed				1.1				3.8				0.9
Shrubs	0.8	0.3			1.3		0.1		0.4			
Graminoids		0.7	2.1	1.1	0.5					0.7	2.2	16.4
Forbs/Ferns	7.6	11.2	9.4	9.7	15.7	6.6	22.2	5.6	3.4	3.1	9.3	14.6
Lichen/ Mushroom	5.9	2.6			1.5	6.1	5.4	6.4	0.8	2.2	5.9	4.9
Fungal Spores			0.1	3.2	3.9			0.9	2.7			0.4
Berry	21.4	62.1	4.8	34.8	27.8	23.7	8.3	25.3	30.6	59.2	21.9	17.3
Seeds	36.4	9.1	21.1	25.0	33.0	55.6	38.8	37.5	30.6	13.7	52.4	26.6
Nut Meat	0.9	2.0	31.2		5.4	3.7	6.5	2.1	15.7	5.4	2.1	
Flower	6.4	0.6	2.7	5.3	4.2				4.4	6.0		0.9
Invertebrate	19.3	10.3	27.2	9.6	5.4	2.6	17.2	17.1	10.1	9.3	1.3	12.2
Other	1.3	1.1	1.4	10.2	1.1	1.7	0.9	1.3	1.4	0.4	4.9	5.8

Table 8. Percent relative frequency of food items in yellow-pine chipmunk stomach contents from 3 shrub community types, Boise National Forest, Idaho, 1993.

Food Item	Grid	A				B				C			
	Session	1	2	3	4	1	2	3	4	1	2	3	4
Conifer needle		1.9											
Conifer seeds					20.9								
Shrubs		1.6											
Graminoids		1.0	1.2		7.9	0.6	0.8			1.3	0.1	0.3	
Forbs/Ferns		6.2	1.3	0.4		4.1	8.2	1.5	1.9	3.6	2.3	1.3	0.4
Lichen/ Mushroom		3.9			29.5	32.7	11.1		29.0	25.2	18.3	6.4	8.6
Fungal Spores						0.3			6.5	6.0			
Berry		35.8	76.8	94.5	9.3	19.9	34.6	15.2	2.7	16.2	74.0	16.9	65.9
Seeds		5.5	5.6	1.4	28.9	21.4	32.4	34.9	28.1	22.9	1.0	15.5	5.7
Nut Meat		2.6	12.9		2.7	1.8	3.9	47.8	26.8	13.3	1.9	54.9	0.4
Flower		20.6				7.8	9.0			6.6	2.1		0.3
Invertebrate		5.1	2.2	3.5	0.7	10.3			4.6	3.3		0.9	14.3
Other		15.8		0.4	0.1	1.1		0.6	0.4	1.6	0.3	3.8	4.4

Table 9. Percent frequency (freq) and cover of shrubs in 3 communities, Boise National Forest, Idaho, 1993.

Species[1]	Grid A Freq(cover)	Grid B Freq(cover)	Grid C Freq(cover)
ACGL	0.0(0.0)	20.0(1.0)	37.5(3.0)
AMAL	75.0(4.6)	80.0(6.1)	87.5(7.1)
BERE	56.3(2.5)	93.3(2.5)	75.0(0.8)
CEVE	100.0(27.0)	53.3(2.8)	75.0(10.4)
LOUT	12.5(0.8)	0.0(0.0)	0.0(0.0)
POTR	37.5(0.2)	0.0(0.0)	0.0(0.0)
PREM	6.3(1.5)	26.7(0.6)	43.8(3.5)
PRVI	37.5(2.0)	53.3(6.0)	12.5(0.7)
PUTR	6.3(0.1)	0.0(0.0)	0.0(0.0)
RICE	18.8(0.4)	13.3(0.3)	18.8(0.9)
RIVI	12.5(0.6)	20.0(0.8)	50.0(1.4)
SASC	43.8(5.6)	6.7(0.2)	37.5(4.1)
SACE	0.0(0.0)	0.0(0.0)	6.3(1.0)
SHCA	0.0(0.0)	0.0(0.0)	18.8(0.2)
SOSC	6.3(0.1)	13.3(0.1)	25.0(1.0)
SYOR	62.5(1.5)	93.3(8.2)	93.8(6.3)

ACGL, mountain maple (*Acer glabrum*)
AMAL, serviceberry (*Amelanchier almifolia*)
BERE, Oregon grape (*Berberis repens*)
CEVE, ceanothus (*Ceanothus velutinus*)
LOUT, Utah honeysuckle (*Lonicera utahensis*)
POTR, quaking aspen (*Populus tremuloides*)
PREM, bittercherry (*Prunus emarginata*)
PRVI, chokecherry (*Prunus virginiana*)
PUTR, bitterbrush (*Purshia tridentata*)
RICE, squaw currant (*Ribes cereum*)
RIVI, sticky currant (*Ribes viscosissimum*)
SASC, Scouler willow (*Salix scouleriana*)
SACE, blue elderberry (*Sambucus cerulea*)
SHCA, russett buffalo-berry (*Shepherdia canadensis*)
SOSC, mountain-ash (*Sorbus scopulina*)
SYOR, mountain snowberry (*Symphoricarpos oreophilus*)

Table 10. Percent of blocks in various community types for 3 shrub communities, Boise National Forest, Idaho, 1993.

Shrub Community Type[1]	Grid A	Grid B	Grid C
Depauperate		6	
Early Seral			
CEVE-CEVE	69		31
CEVE-PRVI	6		6[2]
CEVE-SASC	13		6
CEVE-AMAL	6	27[3]	
Total early seral:	94	27	43
Mid-seral			
SASC-SASC	6		6
SASC-AMAL			14
PRVI-PRVI		33	
PRVI-AMAL		7	6[3]
Total mid-seral:	6	40	26
Late seral			
AMAL-AMAL		27[3]	31[3]
Total late seral:	0	27	31

[1]The first species indicates the seral status, the second species indicates the dominant species (Steele and Geier-Hayes 1987, 1989, 1994):
AMAL, serviceberry (*Amelanchier alnifolia*)
CEVE, ceanothus (*Ceanothus velutinus*)
PRVI, chokecherry (*Prunus virginiana*)
SASC, Scouler willow (*Salix scouleriana*).

[2]On this Grid, the PRVI is PREM, bittercherry (*Prunus emarginata*), the alternate community type indicator.

[3]On this Grid, the AMAL is a mix of AMAL and SYOR, mountain snowberry (*Symphoricarpos oreophilus*), the alternate community type indicator.